

Indiana's *Hardwood Ecosystem* *Experiment* Research Project



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HEE: An Introduction



The Need for HEE

- ☞ Regional oak regeneration problems
- ☞ Impacts of forest management?
- ☞ T&E species and forest ecology
- ☞ Social, cultural impacts
- ☞ Need to address complex, controversial issues with locally derived, science-based information



HEE: An Introduction



Hardwood Ecosystem Experiment (HEE)

- ☞ Long-term, landscape scale experiment study of forest management and its impacts
- ☞ Yellowwood & Morgan-Monroe SFs
- ☞ DoF & Purdue major partners, researchers from several regional universities





HEE Partnering Organizations and Agencies

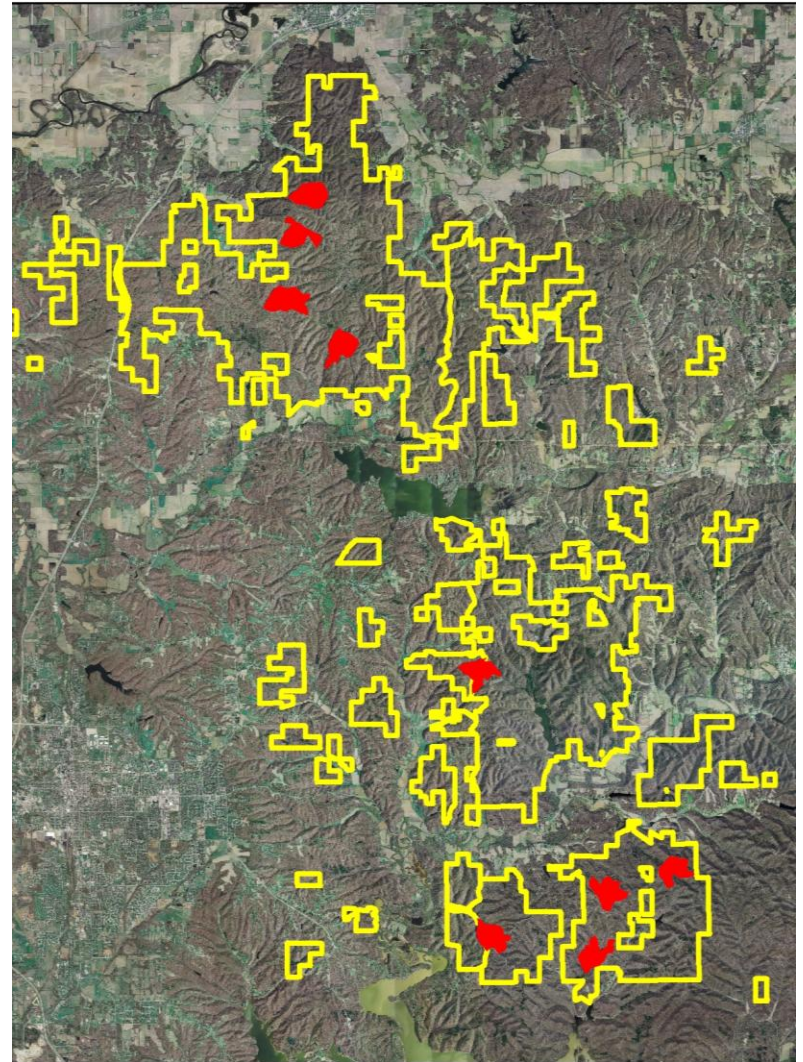
- Ball State University
- Drake University (Iowa)
- Indiana State University
- IDNR, Division of Forestry
- IDNR, Div. of Fish and Wildlife, Wildlife Diversity Section
- IDNR, Division of Parks and Reservoirs
- Indiana University of Pennsylvania
- Purdue University, Dept. of Entomology
- Purdue University, Dept. of Forestry and Natural Resources
- The Nature Conservancy in Indiana
- U.S. Forest Service

HEE: An Introduction



9 Study Areas, 3 Treatments...

- Even-aged
 - Clearcut (10 ac)
 - 3-stage Shelterwood (10 ac)
- Uneven-aged
 - Group and single-tree selection
 - 1, 3, 5 acre openings
- Controls
 - No harvest



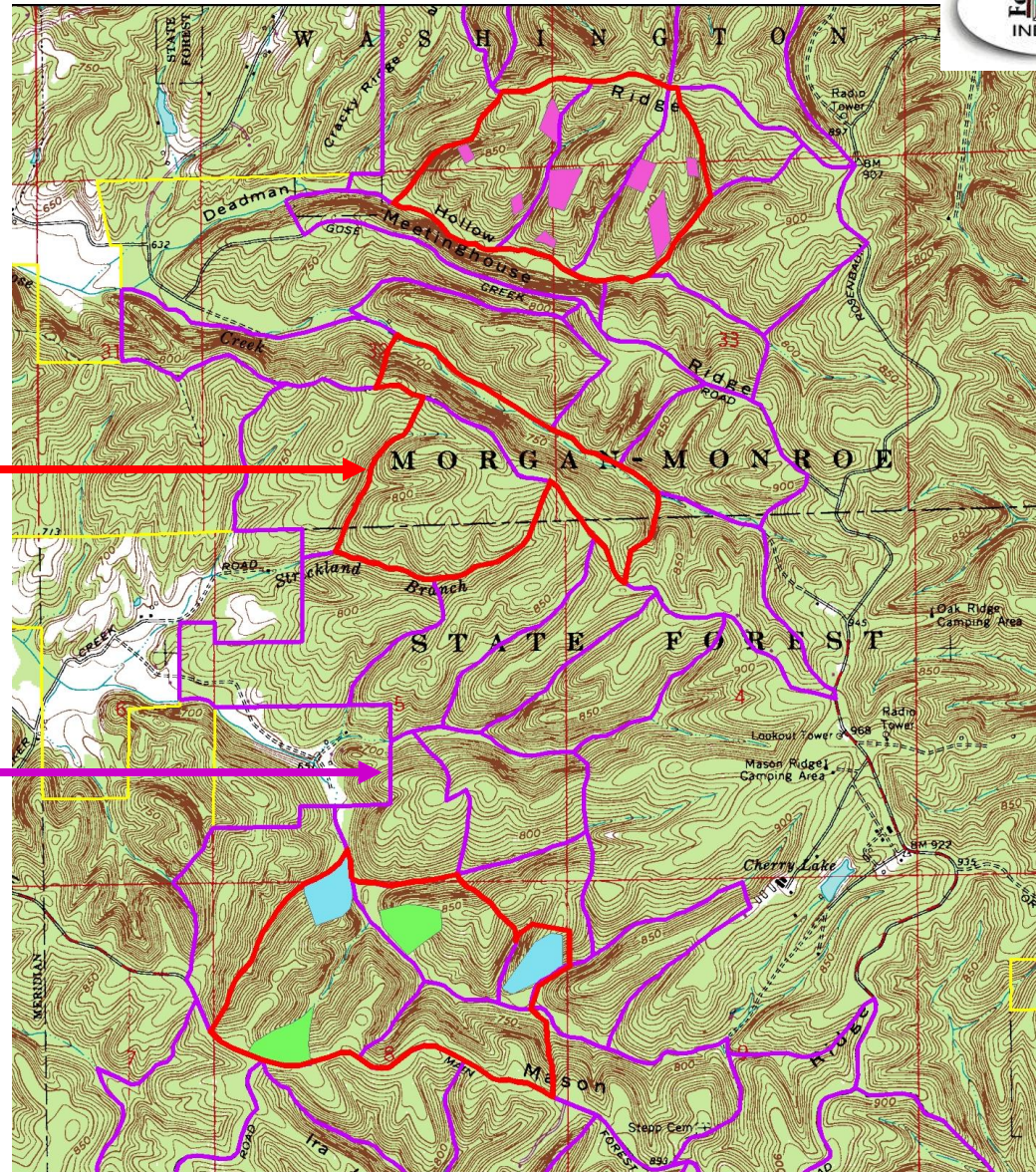
HEE: An Introduction



Management
Units = Buffer
& Cores

Core Research
Area (200-250
acres)

Buffer
Area
(500-700
acres)



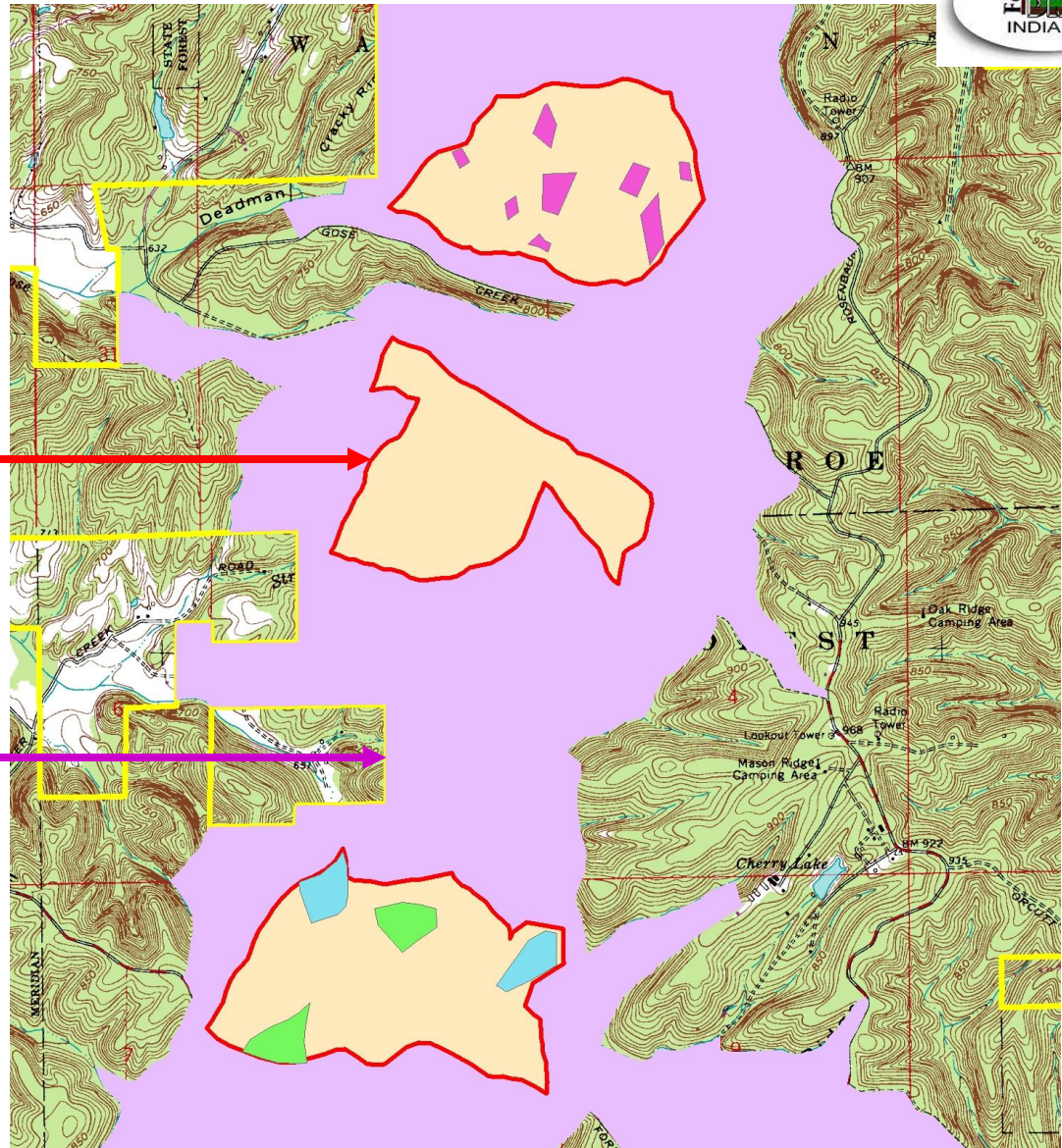
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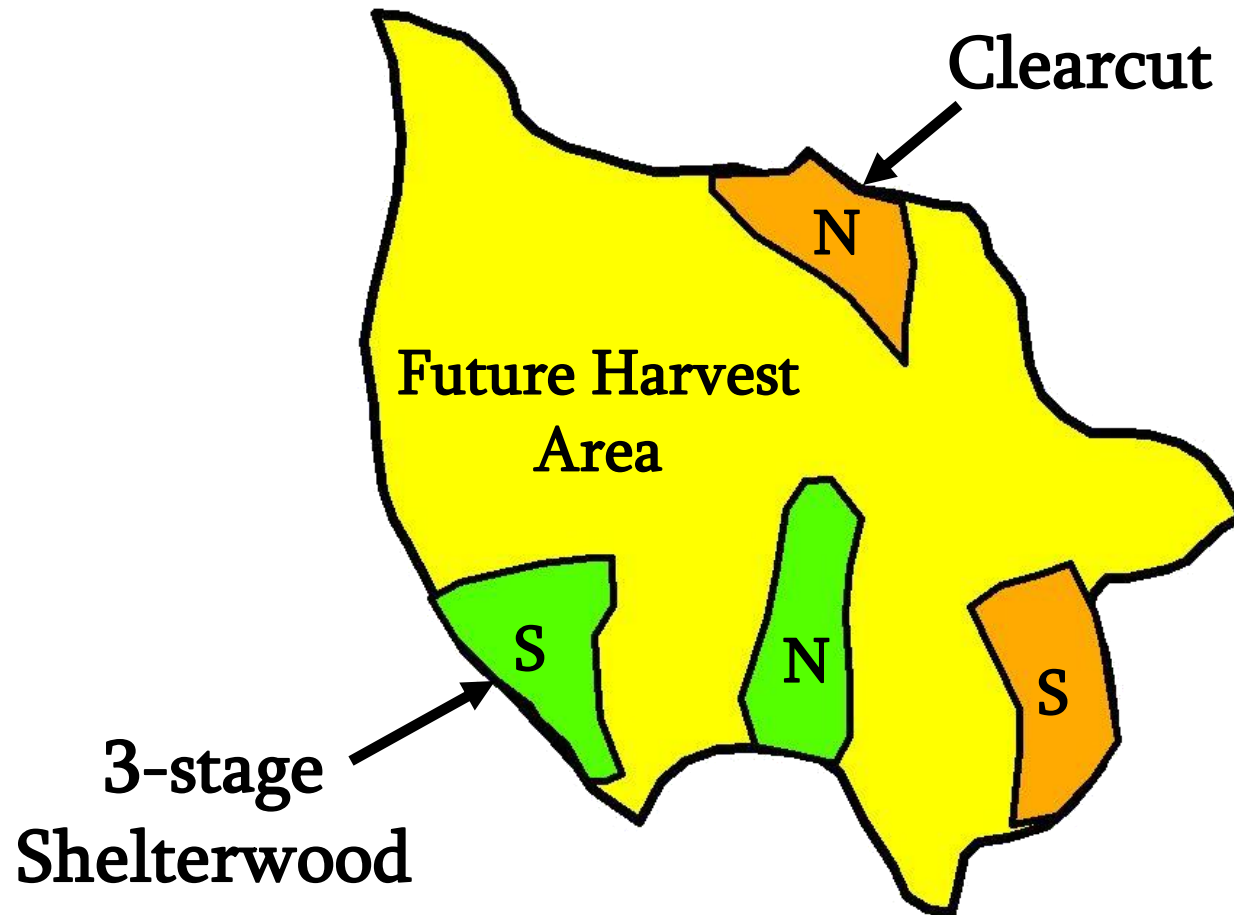
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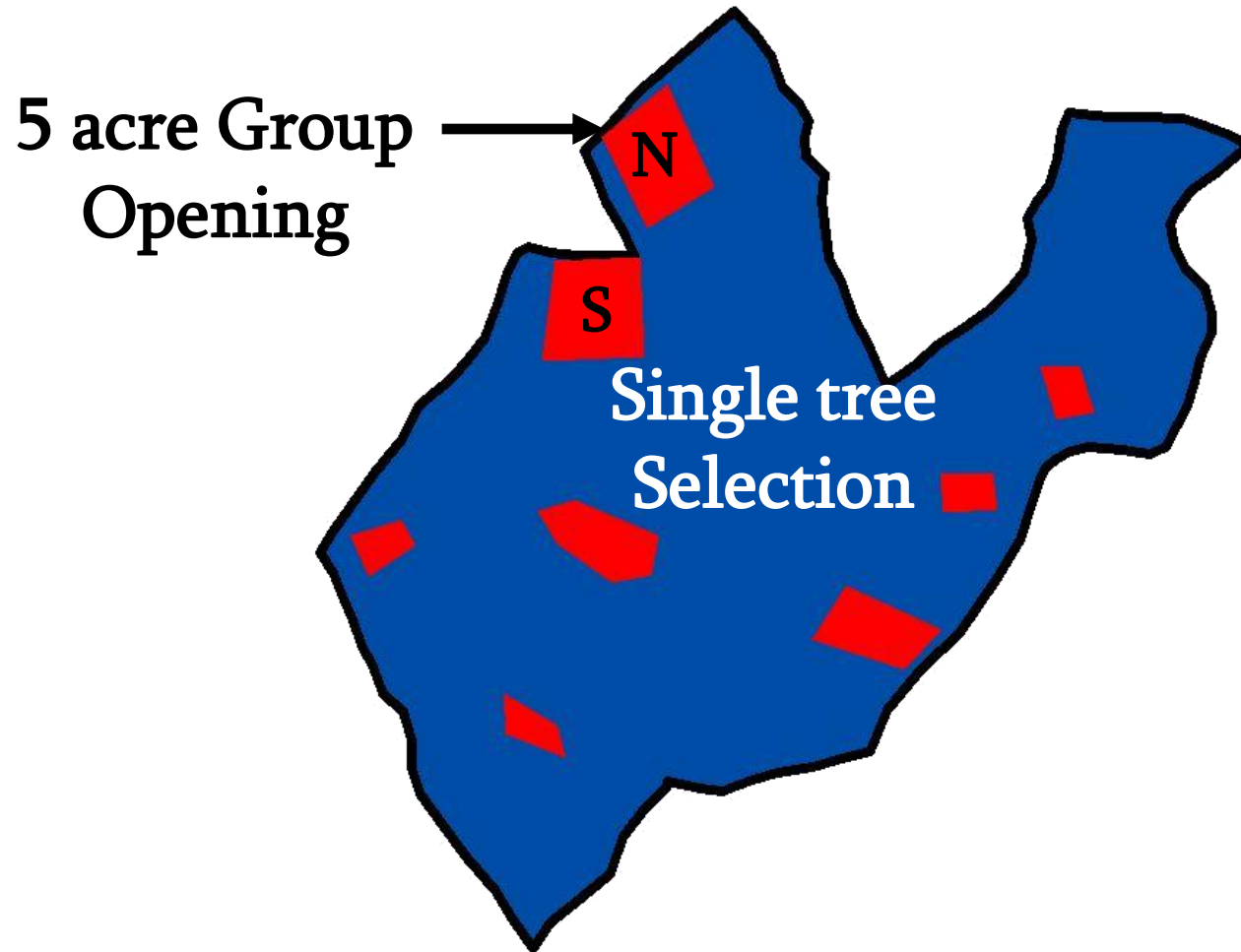
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(500-700
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Even-age Management Units



Uneven-age Management Units





Primary Objectives

1. **Develop even- and uneven-aged silvicultural systems that maintain oak-dominated forest communities and landscapes**
2. **Determine the impacts of these systems on diverse plant & animal communities**
3. **Determine the social and economic ramifications locally and regionally**
4. **Provide demonstration sites and develop novel educational materials to engage the public concerning forest management**

HEE: The Harvests



- ☞ Pre-treatment studies: 2006-2008
- ☞ Harvests: Fall 2008 - Winter 2009
- ☞ Post-treatment studies: 2009...
- ☞ 20 year re-entry

MAY 2008 - PRE-HARVEST



UNIT 1 - UNEVEN-AGED MANAGEMENT - 1 ACRE OPENING

NOVEMBER 2008 - POST-HARVEST



HEE: The Harvests



**Morgan-Monroe SF
“Main Road”
Clearcut**

**First growing season
after harvest (2009)**



HEE: The Harvests



Yellowwood SF Clearcut before TSI

HEE: Preliminary Results



Bats (ISU)

- 2006-09: 472 bats of eight species captured, including 18 Indiana bats
- No differences in bat community across years
- Acoustic sampling in each unit
- More activity detected after harvests
- All but one species were detected in canopy gaps the most, followed by forest edges, corridors, then interiors



HEE: Preliminary Results



Rattlesnakes & Box Turtles (Purdue)

- 38 snakes and 43 turtles radiotracked (2007-10)
- No indication that timber harvests are affecting home range or habitat use
- Turtles in some openings year round
- Turtles prefer opening edges?



HEE: Preliminary Results



Small Mammals (Purdue)

- 5,703 captures of 7 species from 2007-09
- Pre-treatment populations similar across treatment areas



HEE: Preliminary Results



Forest Salamanders (Purdue)

- 14K captures of 9 species in 2007-09
- Eastern redback salamander 64% of captures
- Avg captures per sampling occasion:



	<i>Pre-Tx</i>	<i>Post-Tx</i>
Even-age	9.1	9.8
Uneven-age	8.9	7.3
Control	11.7	8.8
<i>Total</i>	<i>9.3</i>	<i>8.7</i>



HEE: Preliminary Results



Wood-boring and longhorned beetles (Purdue)

- 2006-09: 4249 individuals, representing 104 species
- 2010: 120 species
- Increases in abundance and species richness post-harvest
- Pest species more abundant after harvest, other changes in dominance



HEE: Preliminary Results



Forest Moths (Drake University)

- 3 unit intensive trap sample (2007 & 2009)



	Pre-Tx	Post-Tx	Total
Individuals	11,572	6,234	17,806
Species	278	210	314

Species richness *significantly lower* in
harvest areas than controls

HEE: Preliminary Results



Cerulean Warbler (Ball State Univ.)

- 353 singing males recorded (2007-2009)
- No change in abundance or territory size pre- to post-harvest
- Do not seem to be avoiding the harvested areas
- Smaller territories after even-age harvest?
- Territories associated with small canopy gaps?
- Territories shifting toward harvests?



HEE: Preliminary Results



Breeding Season Songbirds: 2006-2010

Pre-Harvest Post-Harvest

Avg. Individuals	6512	8222	+ 26.2%
Avg. Species	60	67.5	+ 12.5%



HEE: Preliminary Results



Songbirds: 2010 Results

	<i>Species</i>	<i>Avg Birds Per Point</i>
Even	62	30.5
Uneven	69	31.7
Control	45	23.8



HEE: Preliminary Results



Songbirds: 2010 Results

SPECIES	EVEN Per point	UNEVEN Per point	CONTROL Per point
REVI	2.96	2.95	2.93
ACFL	2.54	1.99	2.56
WEWA	1.85	1.00	1.68
ETTI	1.90	1.81	1.85
EAWP	1.57	1.78	1.62
HOWA	1.23	1.70	1.08
WOTH	1.40	1.22	0.97
OVEN	1.50	0.98	1.25
BHCO	1.26	1.13	1.37
SCTA	0.89	1.03	1.26

HEE: Deer Herbivory Impacts



Deer Herbivory Impacts Study

- Exclosures 70' x 70', approximately 7.5 feet tall
- Cedar posts and heavy-duty plastic mesh
- Fenced plots paired with open plots

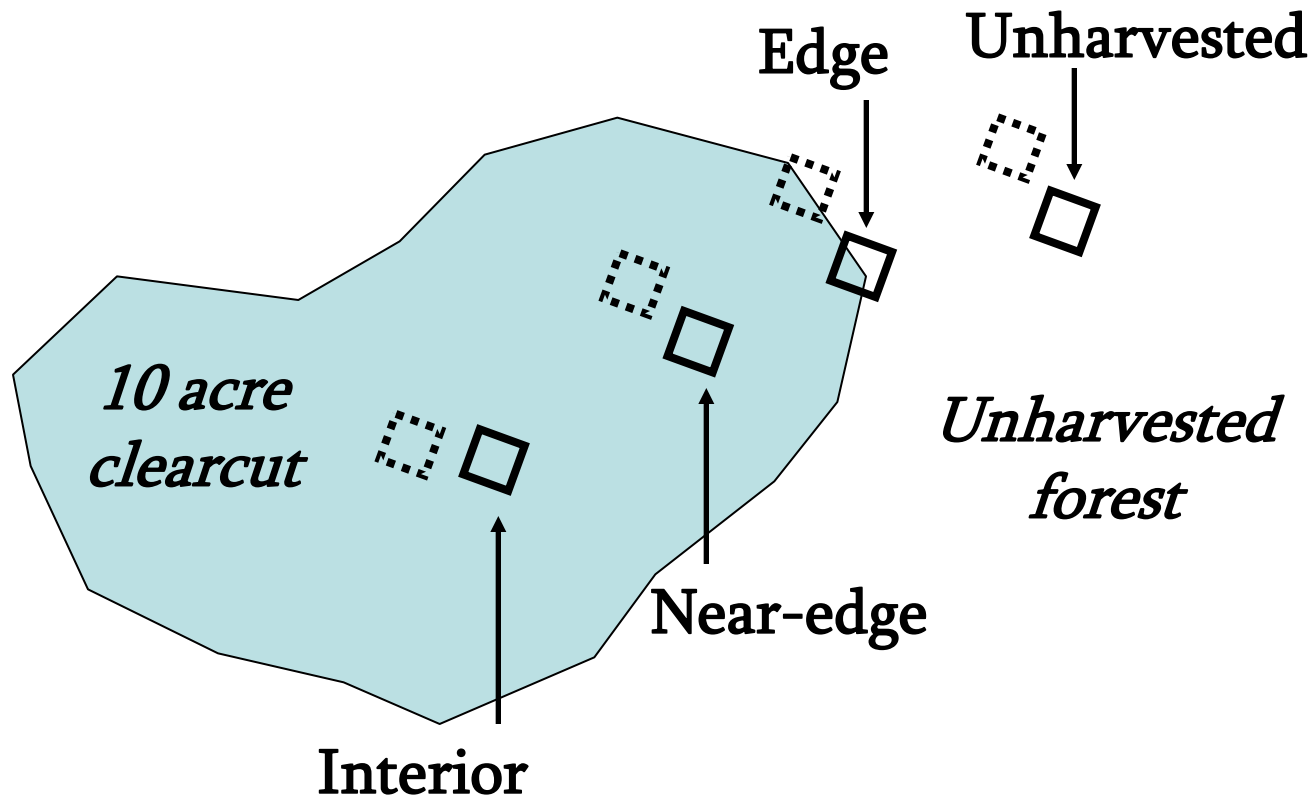


HEE: Deer Herbivory Impacts



Deer Herbivory Impacts Study

- 32 exclosures (44 eventually)
- 4 sets at **clearcut sites (4)**...

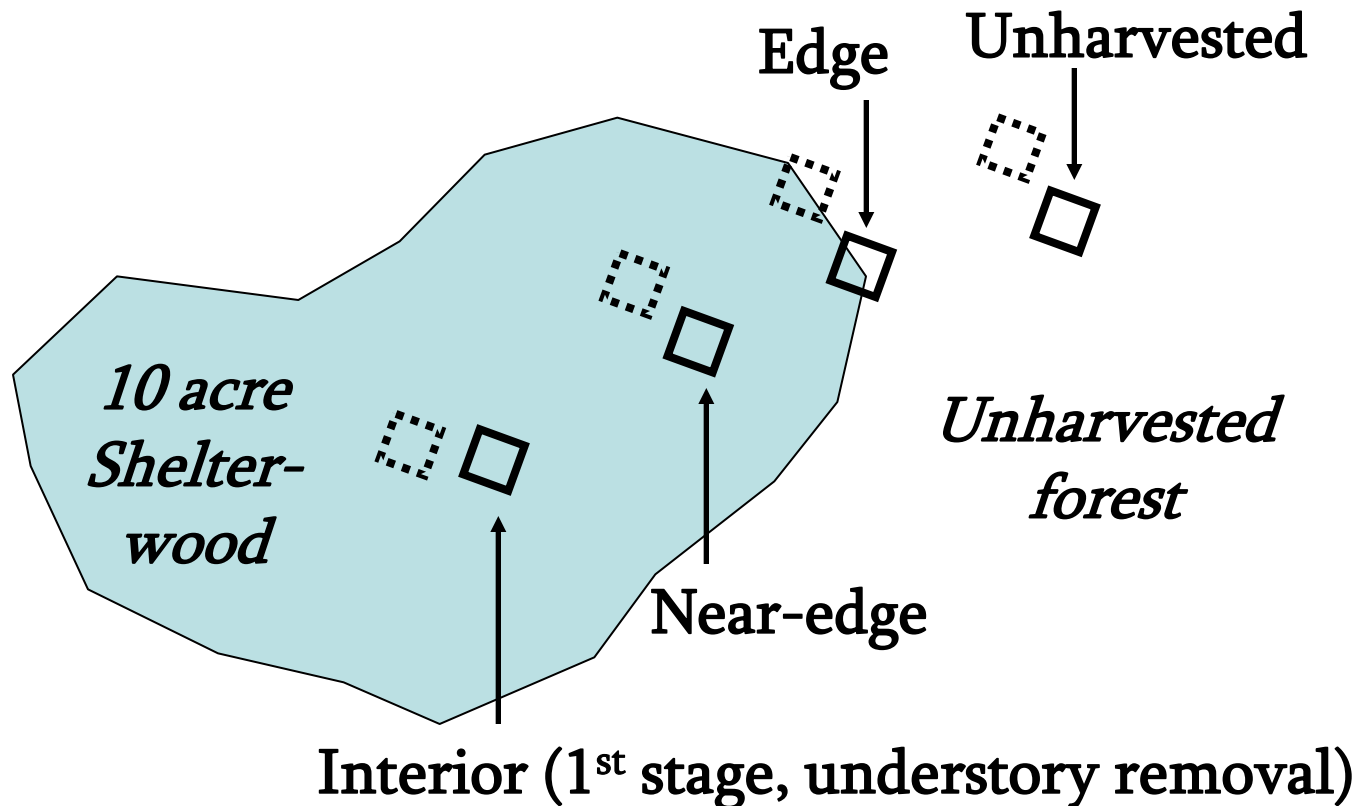


HEE: Deer Herbivory Impacts



Deer Herbivory Impacts Study

- 32 exclosures (44 eventually)
- 4 sets at **shelterwood sites (4)**...

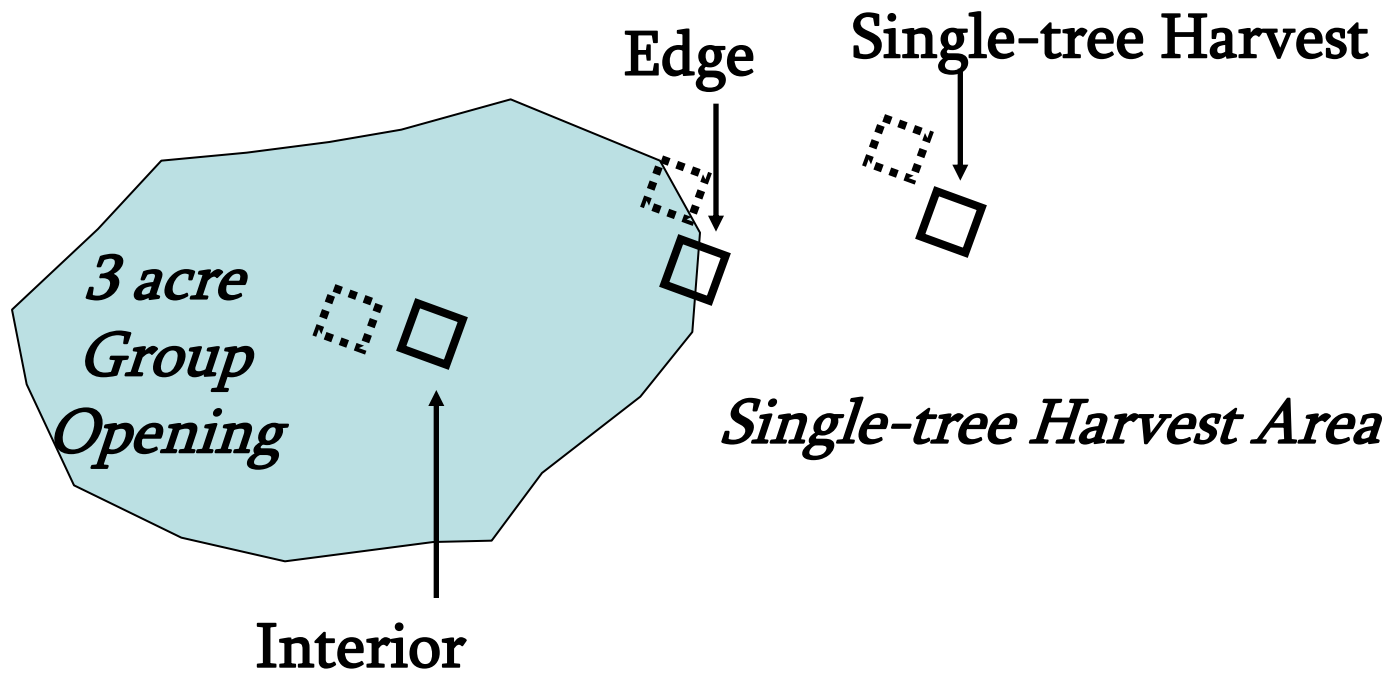


HEE: Deer Herbivory Impacts



Deer Herbivory Impacts Study

- 32 exclosures (44 eventually)
- 3 sets at **Uneven-age sites (4)**...



HEE: Deer Herbivory Impacts



Deer Herbivory Impacts Study

- 2 growing seasons after exclosures built
- No data collected yet, but some differences...



HEE: Other Studies...More to Come!



Other Studies...

- Mast Production and Removal (Purdue)
- Barred and Screech Owl Survey (Purdue et al.)
- Non-breeding Season Bird Survey (Purdue)
- Ruffed Grouse Drumming Survey (DoF and Purdue)



HEE: Getting the Word Out



Getting the word out...

- Publications, theses, and dissertations
- Pre-treatment anthology: USFS GTR, 2012
- Public programs, field days, citizen research
- Professional conferences and field trips
- Much more to come...

Sustainably Managing Forests for Our Future



What will our forests
be like in 100 years?



HEE: Follow Us On The Web



For more information:

<http://www.heeforeststudy.org/>

